Patent claims

1. Display device with touch sensor, consisting of an electrochromic cell known per se or a liquid crystal cell, characterized in that the electrochromic cell or the liquid crystal cell is located between a transparent cover plate (1) and a transparent support plate (2), and a radiation source (3) whose light enters the cover plate (1) and illuminates it, is arranged on at least one of the end faces of the transparent cover plate (1), and in that at least one photodetector (4), in whose photosensitive solid angle range some or all of the cover plate surface lies, is mounted on the support plate (2).

2. Display device with touch sensor according to claim 1, characterized in that the electrochromic cell consists of a transparent top plate (5) and a transparent bottom plate (5'), the two plates (5), (5') being joined together by a ring seal (6) to form a cell, and an electrochromic medium (10) being located in the cell volume, and the plates (5), (5') being provided with a transparent electrically conductive coating (7'), (7) on their sides facing the electrochromic medium.

3. Display device with touch sensor according to claim 1, characterized in that the liquid crystal cell consists of a transparent top plate (302) and a transparent bottom plate (302') which are joined together by a ring seal (303) and between which the liquid crystals (301) are located, the sides of the plates (302), (302') which face one another being provided with a transparent electrically conductive coating (304), (304') and with an orienting layer (305), (305'), and the sides of the plates (302), (302') which are remote from one another being provided with a polarization film (306), (306').

4. Display device with touch sensor according to one of claims 1 to 3, characterized in that the electrochromic cell or the liquid crystal cell has a coating on the bottom plate, which predominantly reflects visible light while it is predominantly transparent to the light emitted by the radiation source.

5. Display device with touch sensor according to one of claims 1 to 3, characterized in that the electrochromic cell or the liquid crystal cell has a coating on the bottom plate which preferably contains a location transparent to

the light from the radiation source at the center of the photosensitive solid angle range of the photodetector.

6. Display device with touch sensor according to one of claims 1 to 3, characterized in that the electrochromic cell or the liquid crystal cell has a semitransmissive and semireflecting coating on the bottom plate.

7. Display device according to one of claims 1 to 3 or 6, characterized in that the electrochromic medium or the liquid crystal medium is two-dimensionally illuminated from the side facing the support plate.

8. Display device according to claim 7, characterized in that the two-dimensional illumination is carried out through an optically transparent grid plate which is arranged between the bottom plate and the support plate, a light source being arranged on at least one of the end faces of the grid plate and the grid plate having, on the side remote from the support plate, an optically refractive grid-like surface structure for positionally metered emergence of light from the interior of the plate, and a scattering layer serving as an illumination surface being arranged on or over this side.

9. Display device according to claim 8, characterized in that the grid density of the surface structure of the grid plate becomes greater with increasing distance from the light source.

10. Display device according to claim 8 or 9, characterized in that the grid plate is identical to the support plate or to the bottom plate of the electrochromic cell or of the liquid crystal cell.

11. Display device with touch sensor according to one of claims 1 to 10, characterized in that the cover plate has a thickness of at least 0.05 mm and preferably at least 0.5 mm.

12. Display device with touch sensor according to one of claims 1 to 11, characterized in that the cover plate has a refractive index of at least 1.5 and preferably at least 1.6.

13. Display device with touch sensor according to one of claims 1 to 12, characterized in that an intermediate layer is located between the top plate of the electrochromic cell or of the liquid crystal cell and the cover plate.

14. Display device with touch sensor according to claim 13, characterized in that the intermediate layer has a refractive index which is less than the refractive index of the cover plate.

15. Display device with touch sensor according to claim 13 or 14, characterized in that the intermediate layer consists of air or UV radiation-polymerizable mixtures of polyfunctional (meth)acrylic acid derivatives, monofunctional (meth)acrylates or suitable photoinitiators, or of solid materials produced using a sol-gel process and having a porosity of more than 50% based on silicates, aluminates and other binary or ternary systems.

16. Display device with touch sensor according to one of claims 1 to 10, characterized in that the bottom plate of the electrochromic cell or of the liquid crystal cell is identical to the support plate and/or the top plate is identical to the cover plate.

17. Display device with touch sensor according to one of claims 1 to 16, characterized in that the radiation source has an emission maximum at a wavelength of more than 680 nm, preferably more than 780 nm and particularly preferably more than 850 nm.

18. Display device with touch sensor according to one of claims 1 to 17, characterized in that the end face illuminated by the radiation source is roughened so as to be weakly scattering.

19. Display device with touch sensor according to one of claims 1 to 18, characterized in that at least one and at most three end faces of the cover plate are coated with an optically reflecting material.

20. Display device with touch sensor according to claim 19, characterized in that gold, silver, copper, nickel or aluminum are used as the optically reflecting material, and the layers are produced by evaporation coating, sputtering, CVD or adhesive bonding of metal-coated films.

21. Display device with touch sensor according to one of claims 1 to 20, characterized in that a plurality of photodetectors are fitted on the support plate, a specific region of the cover plate, which region is uniquely assigned to the photodetector, lying in the photosensitive solid angle range of each photodetector.

22. Display device with touch sensor according to one of claims 1 to 21, characterized in that a unit for processing the electrical signal is connected downstream of each photodetector.

23. Method for touch recognition in the display device with touch sensor according to one of claims 1 to 22, characterized in that the radiation power from the radiation source periodically varies with time at the frequency f_Q, and the electric signal from the photodetector is further processed such that predominantly only that part of the signal which likewise varies periodically with time and approximately varies at the same frequency f_Q as the radiation power from the radiation source is evaluated.

24. Method for touch recognition in the display device with touch sensor according to claim 23, characterized in that the relative width $\Delta f_P/f_Q$ of the frequency band Δf_P accepted during the further processing in the signal from the photodetector around the frequency f_Q is less than 0.1 and preferably less than 0.01.

25. Method for touch recognition in the display device with touch sensor according to one of claims 1 to 24, characterized in that the touch sensor can be switched off fully or for a limited time and, after a predetermined time, switches itself on again or can be switched on again by a specific signal sequence.

Add a1